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OPERATING-ROOM PROCEDURES

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PREPARATION OF LIGATURES, ETC.—*Continued*

SILKWORM GUT.—1. Cook County Hospital. Sterilize with each set of instruments.

2. Johns Hopkins Hospital. Cut in lengths 40 cm., wind around fingers, place in tubes, and sterilize one-half hour.

3. Lakeside Hospital. Wash gut with soap and water, rinse well. Sterilize, as above, or boil ten minutes, which makes the gut very pliable, or put two or three crystals of methylene blue in water and boil the gut in that, so giving it a blue color.

4. Presbyterian. Boil white silkworm gut for thirty minutes. To dye it, dissolve extract of logwood, $\mathfrak{3v}$, copper sulphate, $\mathfrak{3ii}$, in two pints of water, and boil the gut in this solution five minutes.

Horsehair.—1. Syms Operating-Room. Scrub with a brush, soap, and hot water. Soak for three hours in 1–1000 bichloride. Wash well in 95 per cent. alcohol. Place in tubes, cotton plugged, sterilize for one-half hour, at twelve pounds' pressure on two days.

2. Cook County Hospital. After scrubbing, immerse in sulphuric ether for twenty-four hours. Boil in sterile water twenty minutes. Preserve in 95 per cent. alcohol.

3. Augustana. Silkworm gut and horsehair are prepared in the same way as silk.

Silver Wire.—1. Syms Operating-Room. Boil for one-half hour before using.

Sterilization of Catgut.—1. Johns Hopkins Hospital. First Part. For all sizes: (1) Have sterilizer thoroughly cleaned (with ether) of all alboline; (2) line basket with filter paper full of large holes; (3) drop catgut in loosely and do not fill sterilizer over half full; (4) have top of sterilizer off and all pet-cocks removed; (5) place bulb of thermometer near top of catgut; (6) heat to 85° C. ii about one hour; (7) cover sterilizer with card-board top and take one-half hour to raise temperature to 100–105° C.; (8) keep temperature at 100–105° for one-half hour; (9) pour on alboline heated to temperature 100° C. Disturb catgut frequently during drying.

Second Part. I. For No. 1 catgut: (1) Keep at 100–105° C. for one hour; (2) raise to 150° C., remove light and let cool. II. For

No. 2 catgut: (1) Keep at 100–105° C. for two hours; (2) same as above. III. For No. 3 and formalin catgut: (1) Keep at 100–105° C. for three hours; (2) same as for Nos. 1 and 2.

NOTE.—Sterilize only on a dry day and in a dry room. Sterilize only one size or kind of catgut at a time.

All catgut to be cut into lengths 40 cm., ten strands. Wind around fingers into coils. Dry thoroughly in sterilizer with all valves open, allowing five hours for temperature to reach 80° C. and keep between 80° C. and 85° C. for three hours more. Close the valves, turn out the lights, pour on cumol and boil for one hour at temperature 150–165° C. Turn out the lights. Draw off the cumol and allow the temperature to drop to 80° C. Keep at 80° C. for about one hour. Place in sterile tubes direct from the cage with sterile forceps. Hands should be cleaned as for an operation.

The strength of catgut has been found to depend largely on the length of time it is kept after sterilization. If possible, do not use under two months.

2. Augustana. Catgut is prepared by immersing in sulphuric ether for one month; then for one month in strong commercial alcohol, in which one grain of corrosive sublimate to the ounce has been dissolved, the solution being renewed once during this time. It is then preserved indefinitely in a solution of one part of sterilized iodoform, five parts of ether, and fourteen parts of strong commercial alcohol.

3. Syms Operating-Room. To prepare plain catgut without boiling: Mercuric chloride, gr. XV; acid tartaric, gr. LXXV; ether and Columbian spirits, āā 0 i. Soak the raw gut in this solution, No. 0, four hours; 1, six hours; 2, eight hours; 3, twelve hours; 4, sixteen hours; 5, twenty hours. Remove and store in Columbian spirits. May be served from Columbian spirits or 95 per cent. alcohol.

Chromicized Catgut.—1. Augustana. The catgut is immersed in ether for one month, then in a solution prepared as follows: Dissolve one ounce of chromic acid in five ounces of water, and add to this one quart of pure glycerin. Immerse the catgut in this solution for seventy-two hours, then wind on wooden boards or ground edged slides, and place in a solution of one part carbolic acid in five parts of glycerin for two weeks; then preserve indefinitely in the iodoform-ether-alcohol solution described above. It is important to dissolve the chromic acid in water before adding the glycerin, in order to prevent an explosion.

2. Syms Operating-Room. Make a solution of chromic acid, gr. xxx, 5 per cent. carbolic acid, one pint. Place the raw gut loosely in this, so that it will be thoroughly permeated. Soak for four to twelve

hours, according to size, or until it is a warm brown color, then remove and wind tightly on a wooden splint and dry for twenty-one days. Sterilize by boiling in 95 per cent. alcohol fifteen minutes on three successive days, changing the alcohol after each boiling.

3. Montreal General. Chromic acid, one part, to five parts of water. Dissolve thoroughly, and use only the clear solution. Take one part of this solution to five parts of glycerin. This gives rise to a dark greenish or brownish compound with evolution of heat. Pour this compound over the loose catgut immediately. Immerse ninety-six hours. Shake the jar occasionally. The catgut is then rinsed in sterile water, wiped with a sterile towel, and wound on reels. Store in carbolic acid and glycerin, one part to five; it will be ready in two weeks, and will last twenty-one days in the tissues.

4. Cook County Hospital. Soak in sulphuric ether fourteen days. Wind on glass spools. Soak in kali bichromicum gr. v to one quart water twelve to twenty-four hours, according to size. Dry in the sun three days. Boil in ammonium sulphate twenty minutes. (Saturated solution at the boiling point.) Wash in cold sterile water fifteen minutes. Keep in 95 per cent. bichloride alcohol.

5. Presbyterian. First dissolve the oil from the catgut by covering it with ether. Allow the ether to evaporate, then put it into the following solution, keeping it in forty-eight hours or one week, according to size. Keep the jar tightly covered: Catgut (rough German), 5i; chromic acid, gr. iv; carbolic acid, 95 per cent., 5i; alcohol, 95 per cent., 5xx.

Dissolve the chromic acid in sterile water, 3i, add the alcohol and lastly the carbolic acid. Add the rolls of catgut without winding. Take the catgut out of the solution at the end of the required time, roll very tightly on glass reels, securely fastening the ends. Boil in 95 per cent. alcohol for one hour under pressure. A special boiler is used for this formula.

6. Royal Victoria Hospital. After preparing the catgut by Claudius's method, it is placed for five to ten or thirty hours, as desired, in the following solution: Bichromate of potash, 1.5 grammes; glycerin, 10 grammes; carbolic acid, 10 grammes; water, 480 grammes.

Dissolve the bichromate of potash in the water, then add the glycerin and acid carbolic. Before placing the coils in the solution, arrange them upon a central core or cylinder nearly the diameter of the centre of the coils, to prevent snarling while in the solution; large test tubes do very well for cylinders. When the tubes are removed from the solution, wrap them in a sterile towel, and leave for drying in a tem-

perature not exceeding 40° to 45° centigrade. The drying process should extend over a space of several days, say one week.

Cut the catgut when thoroughly dry into pieces one metre in length, roll on the fingers into small coils, pack into small glass jars, cover with absolute alcohol sublimated 1-1000. With washer and screw top make the jar fluid-tight, put the small jar into a larger one containing from two to four ounces of absolute alcohol. Screw down air- and fluid-tight and sterilize in an Arnold sterilizer for five hours. Remove the cover of the sterilizer and allow the contents to cool gradually.

By readjusting the washer and filling the jars with absolute alcohol, to replace that lost in the process, the catgut is ready for use.

Formalin Catgut.—1. Presbyterian Hospital. Roll the catgut tightly and evenly on glass reels, tie the ends securely, immerse in formalin solution, 5 per cent. for forty-eight hours. Pour off the formalin and immerse in cold sterile water, changing it every hour for forty-eight hours. Boil between layers of non-absorbent cotton for eight minutes, simply have enough water in the bottom of a basin so that a good steam permeates the whole; the catgut must not be in water.

Preserve in the following solution: Alcohol, 95 per cent., 800 parts; sterile glycerin, 200 parts; bichloride mercury, 1 part.

2. Johns Hopkins Hospital. Catgut to be placed loosely on cylinders with ties cut to allow for swelling and held in place by rubber bands. Soak in formalin 10 per cent. form., 100 c.c., water, 900 c.c., for five hours. Remove from formalin. Wash in running water twelve to sixteen hours. Roll the catgut smoothly on wide bandages. Dry thoroughly (four to five days at least). Cut in lengths 40 cm. Wind around fingers into coils.

Iodine Catgut.—1. Royal Victoria Hospital. Claudius's method. The usual commercial variety is placed in a covered glass jar containing 1 per cent. iodine in distilled water, with sufficient iodide of potassium to saturate. After eight days this solution is drained off and the catgut is covered with absolute alcohol, sublimated, 1-1000, from which solution the catgut is used. The iodine is volatile and should be renewed each month (or the solution made fresh for each sterilization). If the catgut is too long in the iodine solution it becomes brittle.

2. Montreal General. Same as above, except that on taking the catgut from the iodine solution it is put in a sterile container and is used dry.

3. Presbyterian. Same as above, except that during immersion the catgut is kept in a dark closet and is ready for use after the eight days.

Juniper Catgut.—Montreal General. Catgut in lengths of about sixty inches is wound in rings and placed in juniper oil for eight days, transferred to absolute alcohol for forty-eight hours, and stored in sublimated alcohol, 1-500.

Dressings, Gowns, Towels, Aprons, Sheets, Etc.—1. Royal Victoria. Sterilize for one hour at fifteen pounds' pressure, then leave for three-quarters of an hour to dry with the steam on, the door closed, water drained off, and the valve at the top open.

2. Syms Operating-Room. Pack in iron boxes. Sterilize one-half hour at twelve pounds' pressure.

3. Augustana. Put in the steam sterilizer for two hours for steaming and one hour for drying.

Basins, Pans, Jars, etc.—1. Augustana. Boil in soda and water for one hour, then wrap in sterile sheets until used.

2. Lying-in Hospital. Boil twenty minutes in a covered boiler.

3. Syms Operating-Room. Soak for one hour in 1-500 bichloride solution.

Rubber Tissue.—1. Presbyterian. Dr. Webster's preparation. Roll silk on glass slides, boil thirty minutes in 1 per cent. soda solution, allow to stand in cold sterile water for six hours, boil in plain, sterile water thirty minutes, place in 95 per cent. alcohol forty-eight hours. Immerse in gutta percha solution (gutta percha, one part, turpentine, ten parts). Boil in saline solution one hour, store in chinosol solution, 1-500.

2. Cook County Hospital. Scrub with green soap and water, rinse in sterile water, cut in strips, disinfect in bichloride, 1-500, for twenty-four hours, remove solution and let stand in sterile water three hours. Make hands surgically clean, dry the tissue with a sterile towel and wrap it in sterile paraffin paper. It keeps much longer dry than in solution.

3. Syms Operating-Room. After scrubbing and rinsing as above, it is soaked for twenty-four hours in bichloride 1-1000, and is stored in a similar solution or in sterile salt solution. If salt solution is used it must be changed frequently.

Iodoform Gauze.—1. Johns Hopkins Hospital. Gauze, two yards; salt sol., $\mathfrak{5vi}$ or 180 c.c.; iodoform pulv., $\mathfrak{3xii}$ or 48 c.c.; green soap, enough to make soap suds. Mix ingredients thoroughly and rub into gauze.

2. Lakeside Hospital. For eighteen yards of gauze, take iodoform. $\mathfrak{3iv}$; glycerin, $\mathfrak{5xii}$; alcohol, $\mathfrak{3xxxii}$; ether, $\mathfrak{3xxviii}$. Cut gauze in one-yard lengths. Thoroughly mix iodoform and glycerin, then add

alcohol and ether last. When the ether is added, put the gauze in the mixture, working quickly. The gauze should then be rubbed through the hands, so that the iodoform be evenly distributed. It is well to divide the mixture into two or three portions, the gauze likewise, and to allow two or three nurses to work at one time. Sterilize in autoclave fifteen minutes at ten pounds' pressure. The tubes should be well wrapped in non-absorbent cotton to prevent the gauze from burning.

3. Presbyterian. Same as Lakeside, except that one-fourth more iodoform is used to the same amount of other ingredients. Press the gauze uniformly to preserve evenness of color; too much ether gives a green color. To make this gauze the hands should be prepared as for an operation. Sterile gauze is used.

4. Cook County Hospital. Immerse one ounce of iodoform in bichloride 1-500 for six hours, then pour off the solution. Take one pint saturated solution boric acid and green soap enough to make good suds. Boil for five minutes, when cool, add one drachm of 95 per cent. carbolic and two ounces of sterile glycerin, then the iodoform. Mix thoroughly. This is sufficient for six yards of sterile gauze.

Chinosol Gauze.—Presbyterian. Chinosol, 6 c.c.; glycerin, 13 c.c.; aqua, 128 c.c. Dip strips of gauze in the above solution, hang up to dry, then roll each strip in muslin and sterilize in the steam sterilizer.

Bismuth Gauze.—Johns Hopkins Hospital. Gauze, three yards; bismuth, $\frac{3}{4}$ oz.; water, $\frac{5}{8}$ vi or 240 c.c.; castile soap, enough to make soap suds. Mix ingredients thoroughly and rub into gauze.

Rubber Gloves.—1. Lying-in Hospital. Test for imperfections by filling with very hot water. Wash inside and out with soap and water, then with hot 1 per cent. lysol solution. Dry inside and out and lay in a box with talcum powder, shake briskly, turn inside out and shake again. Place cotton inside each glove and place in a towel. Put them in the steam sterilizer, alone, as far from the flame as possible, for forty-five minutes. If high pressure is used, thirty minutes are enough. When taken out, the gloves, inclosed in the sterile towel, should be wrapped in sterile paper or placed in a clean box.

2. Presbyterian. Soak in cold water, wash in green soap and water, rinse, and dry. Test, and arrange in pairs. Wrap each pair in a separate piece of gauze and boil ten minutes. Boil the gloves in a wire basket, putting a weight on top to keep them under water. The nurse doing this prepares her hands as for an operation and puts on a gown and gloves. Dry the gloves between sterile towels, powder with sterile talcum powder, and roll in towels.

3. Royal Victoria. Sterilize for ten minutes at ten pounds' press-

ure, to be left with the steam off and the door open for ten minutes. Gloves are boiled and patched after using before sterilizing for use again.

4. Syms Operating-Room. Scrub on both sides with a brush, soap and water. Rinse in ammonia water, boil for two minutes, dry, mend, powder on the inside with talcum. Then turn the cuffs back, and do up in two covers, placing a package (about forty grains) sterile talcum powder in each pair. Sterilize one-half hour at twelve pounds' pressure.

5. Cook County Hospital. Boil in sterile water five minutes, or, if wanted dry, wrap in gauze and muslin, place in the sterilizer in moisture, ten minutes, and dry five minutes, at a temperature of 250° F.

Rubber Drainage Tubes.—1. Syms Operating-Room. These are well washed, then boiled for one-half hour in plain water. Store in 1 per cent. formalin solution.

2. Johns Hopkins Hospital. All drains, cut into desired widths, are sewn together, the edges turned in, rolled, and placed in glass tubes with cotton plugs. Sterilize one-half hour with the plugs in. Drains, 6 inches, cut 12½ inches wide; drains, 4 inches, cut 8½ inches wide; drains, 3 inches, cut 6½ inches wide; drains, 2 inches, cut 4½ inches wide.

Renal and Urethral Catheters.—Johns Hopkins Hospital. After using soak in bichloride 1-1000 for one-half hour. Boil for two minutes with stillettes out; boil for two minutes with stillettes in. Place in sterile towels.

Sea Sponges.—1. Johns Hopkins Hospital. Pound sufficiently to break up the large sand cells. Rinse thoroughly in water 12-14 until clean. Let stand in muriatic acid 2 per cent. sol. (20 c.c. muriatic acid, 980 c.c. water) for 24 hours. Then pass them through potassium permanganate 5 per cent. solution; afterwards decolorize in oxalic acid and rinse through two sterile waters. Leave in bichloride 1-1000 for twelve hours. Rinse through two sterile waters then put them into carbolic acid 3 per cent., where they remain. (After passing through permanganate potassium the sponges must only be handled by hands cleaned up for operation.) *Strength of solutions used:* Muriatic acid, 300 c.c.; litres water, 14 7-10=2 per cent.; crude carbolic, 750 c.c.; water litres, 24¼ = 3 per cent.

2. Syms Operating-Room. Wash and pound thoroughly to remove sand. Soak seventy-two hours in 1-500 bichloride. Rinse in sterile water. Store in 5 per cent. carbolic solution; they must be rinsed in cold sterile water before using.

Sound Oil. (Any Oil.)—Syms Operating-Room. Sterilize by boiling ten minutes in a water bath.

Brushes.—1. Lying-in Hospital. Wash with soap and water, rinse, and steam in a sterilizer thirty minutes. Have two jars for the sterile and used.

2. Syms Operating-Room. Boil for five minutes and place in a 1-25 carbolic solution before operation.

Normal Salt Solution.—1. Lakeside Hospital. Common salt, 3i , add Oi distilled water. Filter and put in Florence flasks. Make stoppers of bandage-gauze and non-absorbent cotton. Tie with small tape. Boil for three consecutive days—15 minutes first day; 10 minutes second day; 10 minutes third day. After each boiling mark the stopper.

2. Johns Hopkins Hospital. Sodium chloride, grms. Vi , mxc, $5\frac{1}{2}$ c.c.; water, litre I (1000 c.c.). Filter through three pieces of filter-paper. One of canvas. Wash flasks thoroughly with soap and water. Plug with raw cotton and gauze covering entire neck of bottle. Sterilize for one-half hour.

Temperature of Salt Solution.—For infusion, 44° C.; for irrigation, abdominal, 38° – 42° C.; for gauze, as hot as desired.

3. Royal Victoria. Sterilize for one hour at fifteen pounds' pressure; let the pressure off very slowly; leave with the steam off and the door open for one-half hour.

4. Lying-in Hospital. Add a drachm of sterile table-salt to a pint of sterile water. A convenient way to sterilize salt is to fill two-drachm vials, cork securely, and sterilize daily for three days, one hour each day.

Iodoform Emulsion.—Lakeside Hospital. Iodoform powder, gr. glycerin, 3i . Sterilize the same as gauze.

Solutions for the Operating Department.—Royal Victoria Hospital. Lysol, 1-500, 3iiss to Oviii ; creolin, 1-160. 3i to Oi ; liquor potassium, 2 per cent., 3viss to qt. i; normal saline, 6-10 per cent., 3i to Oi ; formaldehyde, 1-2000, 3i m48 to Oix ; formaldehyde, 1-20000, miii to qt.i; hydrargium perchloride, 1-1000, 3iv to qt.v; potassium permanganate, sat. sol., 3i to 3xx ; acid oxalic, sat. sol., 3x to 3lxxx ; acid boric, sat. sol., 3iv to 3lxxx ; acid carbolic, 5 per cent., 3iv to 3lxxx .

Laparotomy Sheets.—Syms Operating-Room. For laparotomies two sheets are used, one covering the feet and legs, and another, one yard square, with a hole about ten by four inches in the middle, over the abdomen. This last sheet may be changed during the operation as often as necessary. Sterile towels are placed around the wound when the surgeon begins to suture. After the operation is finished, a towel wet in 1-1000 bichloride is placed over the wound while the patient is being carefully dried, and the binder put under, then the dressings are applied and the binder adjusted.